OVERVIEW INFORMATION

The Air Force Office of Scientific Research (AFOSR) announces a fiscal year 2007 competition for basic research in advanced imaging and non-imaging sciences. This Air Force research effort shall have strong government ties to accelerate the transition of the research results to the government**.** The goal of the program is to fund quality basic research that is applicable to AF needs. The areas to be supported are found in Section I. It is expected that a single award will be made under this BAA; however, AFOSR reserves the right to make more than one award.

- **Agency Name** – Air Force Office of Scientific Research
- **Funding Opportunity Title** - Basic Research in Advanced Imaging and Non-Imaging Sciences
- **Announcement Type** – Initial Announcement
- **Funding Opportunity Number** – AFOSR BAA 2006-05
- **Catalog of Federal Domestic Assistance (CFDA) Number** – 12.800
- **Response Dates** – Closing Date 17 November 2006, 3:00 PM EST

I. Funding Opportunity Description

A. Background: The imaging and characterization of space objects is a cornerstone of space surveillance and a core technical capability required to support the US national interests in space. With the development of rapid launch capabilities and nano-satellites, space situational awareness (SSA) is increasingly critical to provide the vigilance capabilities that will identify, characterize, deter and defend against hostile acts directed at U.S. space assets. In the future, successful combat operations involving aerospace assets will depend on Air Force leaders quickly processing relevant information and then acting decisively. Critical to this process is full-dimensional SSA.

This BAA seeks to enhance the SSA research being conducted within the Air Force Research Laboratory. An important asset to AFRL's basic research in this area is the Air Force Maui Optical and Supercomputing (AMOS) site, a premier Air Force facility where SSA research and development is conducted. AMOS consists of two co-located and interdependent facilities. The first is a world-class space surveillance facility that consists of numerous optical telescopes that are used for imaging, non-imaging, and satellite tracking research and development. The second is a state-of-the-art supercomputing facility that supports numerous high-performance computing programs including SSA. Because observational data and data processing methods are inextricably linked in the generation of SSA information, the co-location of the two facilities makes the AMOS site unique in its ability to provide relevant information to the SSA community. AMOS is currently used primarily to track, characterize, and "photograph" satellites and for conducting research into technologies and techniques for increasing the kind and improving the quality of SSA information. The mild climate, year-round viewing opportunities, state-of-the-art observatory, and one of the world's premier high performance computing centers combine to make the AMOS site a world-class complex for conducting research and development in the critical technology area of SSA.

Researchers are encouraged to work closely with AMOS scientists to develop and transition their research results. Additional information on AMOS, including its research and development mission and its space surveillance mission, can be found at http://www.maui.afmc.af.mil/. This site also includes links to the Maui High Performance Computing Center, the Air Force Research Laboratory, and various links throughout the space sciences community.

B. Objective: The objective of this research initiative is to further explore and develop many of the basic sciences that form the basis for SSA and related technologies that will ultimately support AF mission areas. The focus of this initiative is basic research associated with the characterization of space objects from ground- and space-based sensors.

C. Research Concentration Areas: Areas of interest covered by this BAA include: 1) new and novel approaches to obtaining SSA- using passive or active radiation in the visible to far infrared wavelength regime; 2) image and signal processing research that will result in new or improved algorithms that generate SSA-related information from observational data; 3) enabling mathematics that support the generation, characterization, and interpretation of SSA-related information, and 4) the application of high-performance computing methods to areas (1) – (3).

(1) SSA-Related Data Collection: Types of data that can be collected on satellites in support of SSA include light intensities that are resolved spatially (imagery), temporally (photometry), spectrally (spectrometry), and polarimetrically (polarimetry). Because these data can be distorted by the atmosphere and by optical system imperfections, additional data can be

collected to quantify these distortions with the goal of removing their effects from the data. This BAA seeks new and novel ways to collect these data either more quickly, with higher accuracy, or in combinations (either simultaneously or in series) that increase their SSA-related utility. In addition, this BAA seeks proposals for other data types and methods for their collection and analysis that benefit the SSA mission.

(2) Image and Signal Processing: Image and signal processing algorithms seek to convert data such as described above into useful information. Such algorithms include (but are not limited to) deconvolution, spectral unmixing, light-curve inversion, and basic imaging understanding analyses. Measurements of system distortions can be included in algorithms to aid, for example, in the deconvolution process and to remove spectrally-dependent and elevation-dependent atmospheric absorption. This BAA seeks new or improved algorithms to transform the data collections described above and new types of data into information that has SSA utility. Of particular interest are algorithms that process data from multiple sources/modalities to improve signal to noise and identify value-added information from each source/modality that will increase space situational awareness. Data fusion methods of interest include (but are not limited to) the combination of simultaneous measurements for improved image or signal quality, the combination of measurements over time to enable change detection, and the identification of orientation cues that may be shared in the processing of a diverse set of collaborative sensors. Desirable approaches to image and signal processing may include modeling the physics of the data in order to facilitate performance prediction, characterization and regularization of the inverse problem, data fusion, and system and situational modeling.

(3) Enabling Mathematics: While mathematics is key to nearly every research concentration area, specific interest lies in the following applications or areas:

- Novel approaches to predicting image quality that are applicable to both conventional and non-conventional imaging systems (for example, the Generalized Image Quality Equation is used to predict the quality of terrestrial scene images collected using conventional imaging systems).

- Novel approaches to quantifying the quality and quantity of information generated from data as described in the section above; also novel pattern recognition approaches for imaging and non-imaging.

- Inverse-problem-related research that characterizes the existence and uniqueness of information generated by current or proposed algorithms given the data. This research should be both descriptive and generative, if possible; i.e., if a given approach to data inversion does not generate a unique solution, the research should provide insight into how the problem formulation should be modified to permit a unique solution.

- Methods to improve the performance of iterative algorithms that solve the inverse problem by minimizing cost functions. Such methods include (but are not limited to) preconditioning to improve algorithm speed and convergence, regularization methods that ensure the desired solution is achieved when the algorithm converges instead of employing “regularization by iteration”, and generation of algorithm starting points that speed convergence and limit the possibility of being trapped in local minima.

(4) High-Performance Computing: The timeliness of SSA-related information can play a key role in its usefulness. For this reason, the speed at which information can be generated or systems analyzed plays an important role in the SSA arena. High-performance computing assets such as highly-parallel supercomputers that consist of large numbers of nodes (distributed-memory computers) provide computation speeds far in excess of those possible with single-processor machines. However, it is still non-trivial to develop algorithms to run efficiently in a distributed memory environment. This BAA seeks distributed-memory versions of algorithms developed for image and signal processing that demonstrate scalable speed increases across nodes. In addition, optimized modular distributed-memory versions of important subprograms such as minimization routines and fast Fourier transforms are of interest. The winning team will have access to MHPCC parallel computers.

D. Impact: Improved imaging and characterization techniques will revolutionize SSA, allowing more complete exploitation of information for use by senior decision makers. This information will include precise satellite attitude (allowing accurate determination of where a particular satellite may be pointing as it collects information), satellite status (is the satellite functioning as designed), and details on satellite subsystems (including material composition, structure, vibration, operating conditions and system vulnerabilities).

E. General Proposal Information: Proposals submitted in response to this call for proposals should address all four categories listed above; in addition, successful proposals will describe a well-integrated and focused research plan as compared to a research plan that has a broader scope but is less focused. The principal investigator for the winning proposal will establish a coordinated program interconnecting these four areas and leveraging results in one area to advance another. The principal investigator is expected to play the key role in ensuring the results generated under this project stay focused. In addition, the principal investigator will be responsible for liasoning with the designated Air Force representative to ensure that relevant research results are transitioned to AMOS in a timely fashion. There are several suggested ways that this SSA research can be transitioned to AMOS. Specifically, the principal investigator can:

1. Organize and attend an annual research review meeting at a time and location convenient to the attendance of AFRL and AMOS scientists. Members of the winning team shall also attend the annual review meeting as appropriate.

2. Submit and present papers generated from research conducted under this award should be presented each year at the annual AMOS Technical Conference (http://www.amostech.com/).

3. Present a short course on a topic of importance to this research each year at the AMOS Technical Conference.

4. Give a colloquium on an SSA research topic at AMOS each year at a time agreed upon by the researcher, the principal investigator, and the designated Air Force representative.

5. Provide the designated Air Force representative with electronic preprints of all papers generated by the SSA project researchers that report on the SSA-funded research, information on all conferences at which the project results are to be presented in enough time to permit interested AMOS researchers to attend, and the presentation materials generated for these conferences.

6. Hold quarterly discussions with the designated Air Force representative to identify technologies developed under this program that can be transitioned (partially or completely) to AMOS. The technology transition plan should include:

a. Requirements for a sufficient level of documentation for the technology to be transitioned to enable the Air Force to understand and implement the technology.

b. For transitionable software, the documentation shall also include flowcharts, extensive code comments, a complete description of the system(s) it can run on, the source code, and the compiler needed along with compiler options if it is compiled code.

c. An agreed-upon level of support from the developer(s) of the technology that may include telephone conferences, presentations, on-site assistance, and additional technology development to facilitate the transition.

Beyond the official transition efforts, the principal investigator and the Air Force representative will work together to foster relationships between the SSA project and AMOS researchers to aid in informal technology transition.

Program Managers: Dr. Fariba Fahroo, AFOSR/NM, 703-696-8429, fariba.fahroo@afosr.af.mil; Dr. Kent Miller, AFOSR/NE, 703-696-8573, kent.miller@afosr.af.mil.

F. Schedule of Important Events

Event	Date	Comments
White papers received by AFOSR	15 September 2006	White papers are highly desired, but not required
White paper comments back to submitters	6 October 2006	
Proposals received by AFOSR	17 November 2006 (3:00 PM ET)	Late submissions will not be accepted
Announcement of winner	15 December 2006	Tentative
Award date	1 January 2007	Anticipated

II. Award Information

Subject to the availability of funds and selection of adequate proposals, AFOSR anticipates award(s) of grant(s) or cooperative agreement(s) likely not to exceed $500K per year. It is anticipated that the award(s) will have an initial performance period of twelve months with two twelve-month options. Negotiations may reduce funding of the awards to an amount lower than that proposed.

III. Eligibility Information

All responsible, potential applicants from academia and industry are eligible to submit proposals. AFOSR particularly encourages proposals from small businesses, historically black colleges and universities, minority institutions and minority researchers. However, no portion of this BAA is set aside for a specific group. Cost sharing is encouraged but not required.

IV. Application and Submission Information

Announcement Package

This BAA may be accessed from the internet from the "Research Opportunities" portion of AFOSR's web site (http://www.afosr.af.mil/) through the "Need Funding?" link.

Content and Form of Application Submission

The proposal may be submitted either electronically or in hard copy form, but not both. All proposers must include the SF 424 (R&R) form as the cover page. All proposals, electronic and hard copy, should be NO LONGER THAN 20 PAGES, ALL INCLUSIVE when printed out. Font is to be 10-12 point, on one sided 8 ½ x 11 inch white paper, double-spaced. The SF 424 form(s) are not included in the 20-page limit. Separate attachments, such as institutional brochures or reprints, will not be accepted.

Advanced Preparation For Electronic Submission - Electronic proposals must be submitted through Grants.gov. There are several one-time actions your organization must have completed before it will be able to submit applications through Grants.gov. Well before the submission deadline, you should verify that the persons authorized to submit proposals for your organization have completed those actions. If not, it may take them up to 21 days to complete the actions before they will be able to submit applications.

The process your organization must complete includes obtaining a Dun and Bradstreet Data Universal Numbering System (DUNS) number, registering with the Central Contract Registry (CCR), registering with the credential provider, and registering with Grants.gov. (Designating an E-Business Point of Contact (EBiz POC) and obtaining a special password called MPIN are important steps in the CCR registration process.) Go to http://www.grants.gov/applicants/get_registered.jsp. Use the Grants.gov Organization Registration Checklist at http://www.grants.gov/section3/OrganizationRegCheck.pdf to guide you through the process. If a proposal is submitted through Grants.gov, PureEdge Viewer will need to be downloaded. This small, free program will allow you to access, complete, and submit applications electronically and securely. For a free version of the software, visit the following web site: www.Grants.gov/DownloadViewer. Should you have questions relating to the registration process, system requirements, how an application form works or the submittal process, call Grants.gov at 1-800-518-4726 or support@Grants.gov.

Submitting the Application

For Electronic Submission – Application forms and instructions are available at Grants.gov. To access these materials, go to http://www.grants.gov, select "Apply for Grants", and then select "Download Application Package". Enter the CFDA number for AFOSR which is 12.800, Air Force Defense Research Sciences Program (AFOSR). You should also enter the funding opportunity number for this announcement (AFOSR BAA 2006-5). Then follow the prompts to download the application package.

For Hard Copy Submission – For hard copy submission, the original proposal and nine (9) copies must be delivered to the program manager at the Air Force Office of Scientific Research at the following address:

Program Manager (Dr. Fahroo or Dr. Miller)
Air Force Office of Scientific Research
875 North Randolph Street, Room 3112
Arlington VA 22203-1977

SF 424 (R&R) - The SF 424 (R&R) form must be used as the cover page for all electronic and hard copy proposals. No other sheets of paper may precede the SF 424 (R&R) for a hard copy proposal. Complete all the required fields in accordance with the "pop-up" instructions on the form and the following instructions for the specified fields. To activate the instructions, turn on the "Help Mode" in Grants.gov. (The "Help Mode" is turned on by the icon with the pointer and question mark. This is located at the top of the form). The completion of most of the fields is self-explanatory except the following special instructions:

a. Field 2: In the Applicant Identifier area, please list the appropriate program officer to receive the proposal.

b. Field 3: The State Application Identifier may be left blank.

c. Field 7: Complete as indicated. Please note under "Other (Specify)" if your organization is a Minority Institution (MI).

d. Field 8: Complete fields as indicated.

e. Field 9: List AFOSR as the reviewing agency.

f. Field 20: Use Field 20 to attach the proposal narrative as described below.

Other forms required are: Research & Related Budget, Senior/Key Person Profile, Project/Performance Site Locations and Other Project Information.

Certification - Each proposal must be accompanied by a certification of compliance with lobbying requirements (a statute requires the submission of that certification at the time of proposal submission rather than at the time of award). By using the SF 424 (R&R), proposers are providing the certification required by 32 CFR Part 28 regarding lobbying. (The full text of this certification may be found at

http://www.afosr.af.mil/Documents/funding_GrantCertForm.htm or a copy will be provided upon request.)

Proposal Narrative – Attach the proposal narrative to the SF 424 (R&R) cover sheet (for an application submitted through Grants.gov, electronically attach the proposal narrative at Field 20). The proposal narrative contains the abstract, budget and supplementary information as follows:

Abstract. Include a concise (not to exceed 300 words) abstract that describes the instrumentation requested and the research and research-related education that will be supported by that instrumentation.

Budget. The financial portion of the proposal must contain a cost estimate for the proposed effort including a description of cost sharing arrangements, if any. It is anticipated that the awards will have an initial performance period of twelve months with two twelve month options, assuming a 1 January 2007 effective date. However, the start date is subject to negotiations. Individual budgets should be provided for each period. Should a grant be awarded AFOSR will make payment to educational and non-profit recipients based upon a predetermined payment schedule. Payments will normally be made quarterly in advance of performance, based upon a spending profile which must be provided as part of the proposal. Payments should be limited to the amounts needed to conduct research during each respective period. Educational and nonprofit organizations shall submit a spending profile with their cost proposal. For further details, proposers may refer to the "Proposer's Guide to AFOSR Research Programs" (http://www.afosr.af.mil/ResearchAreas/funding_submitProp.htm).

Submission Dates and Times. Full proposals must be received no later than 3:00 PM Eastern Standard Time on 17 November 2006, whether submitted electronically or in hard copy. Exceptions:

For electronic submission, should the site of Grants.gov not be operational on the due day and is unable to receive the proposal submission, the deadline is extended to the same time of the first day when the site is in operation.

For hard copy submission, in case the operation of a designated agency is interrupted and the agency is unable to receive the proposal, the deadline is extended to the same time of the first day when the agency is in operation.

Application Receipt Notices and Consequence of Late Submission.

For Electronic Submission - The applicant will receive a confirmation page upon completing the submission to Grants.gov. This confirmation page is a record of the time and date stamp that is used to determine whether the proposal was submitted by the deadline. A proposal received after the deadline is "late" and will not be considered for an award. The applicant will receive an e-mail within a few hours of submission indicating that the proposal has been validated by Grants.gov. (This means that all the required fields have been completed.) The third notice the applicant will receive is an e-mail from the designated agency to which the electronic proposal was submitted, to

acknowledge receipt of the proposal and provide the agency's assigned tracking number. The email is sent to the authorized representative for the applicant institution approximately ten days from the proposal due date.

For Hard Copy Submission – An applicant that submits a hard copy proposal to AFOSR will receive an e-mail from the agency approximately ten days after the proposal due date to acknowledge receipt of the proposal and provide the agency's assigned tracking number. The e-mail is sent to the authorized representative for the applicant institution. A hard copy proposal received at an agency's listed mailing address after the deadline is "late" and will not be considered for an award, except for cases in which there is acceptable evidence to establish that the proposal:

a. Was delivered to the agency and was under the agency's control prior to the deadline; or

b. Was sent to the agency's listed mailing address by U.S. Postal Service Express Mail three or more business days prior to the date specified for the receipt of the proposals. The term "business days" excludes weekends and U.S. federal holidays.

Other Submission Requirements

Proposals submitted in whole or in part by electronic media (computer disk or tape, facsimile machine, electronic mail, etc.) will not be accepted (unless the full proposal is submitted electronically through Grants.gov).

V. Application Review Information

A. White papers - White papers, no more than 4 pages, are highly desired (but not required) and may be submitted by 15 September 2006 to allow a timely response by 6 October 2006. White papers should be submitted by e-mail to both of the program managers listed above. A white paper should consist of the following: 1. Identification of the research and issues, 2. Proposed technical approaches, 3. Potential impact on DoD capabilities, 4. Potential team and management plan, and 5. Summary of estimated costs. In addition to the four pages, please include a cover page and curriculum vitae for key research personnel. The white paper should provide sufficient information on the research being proposed to allow for an assessment by a technical expert.

B. Submitting proposals - The technical portion of proposals should be no longer than 20 pages (excluding cover and budget sheets). Hard copy submissions require an original and nine (9) copies of the proposal. Section IV contains instructions for submitting proposals. Proposals will be evaluated using the criteria set forth in Section V.

C. Format and Technical Content Proposals - Each proposal should be typed single sided in 10- or 12-pitch type (maximum of 12 characters per inch), double-spaced, on 8 ½ X 11 inch white paper, bound or stapled to keep documents intact and allow convenient handling. Proposal length, including abstract and text, should not exceed the number of pages listed in Section IV. Attachments, such as institutional brochures or reprints, will not be considered in the evaluation or selection process.

The proposed objective should be the performance of research in support of the program goals delineated in Section II. For this reason, proposals must adequately describe the proposed research (including current state-of-the-art, recent contributions of the proposer, intended technical approach and expected results), objectives, approach and expected outcomes. This information will allow evaluation of prospective research quality and DoD relevance.

1. Cover Page. The SF 424 (R&R) is the cover page.

2. Abstract. The abstract of the proposal should be no more than one page long.

3. Text. The technical portion of the proposal must contain the following:

   a. A conceptual outline of research goals and proposed scientific approaches identifying novel or innovative features.

   b. Describe in detail the research to be undertaken. State the objectives, approach and relationship to the current state of knowledge. Include an appropriate bibliography and list of literature citations. Summarize the expected research results and significance as well as the expected contribution toward meeting the objectives of the program outlined in Section II.

   c. List the qualifications of the principal investigators and estimate the time that each principal investigator and other senior professional personnel will devote to the research.

d. Describe facilities planned for performing the proposed research and any additional facilities or equipment proposed for acquisition.

4. Curriculum Vitae. Furnish vitae for key research personnel, including senior investigators. Provide short biographical sketches and list relevant publications. List names and titles of other scientific or technical personnel who will be directly associated with the project.

D. Evaluation Criteria - The primary criterion for evaluating the proposals will be:

1. The scientific and technical merits of the proposed basic research, together with the proposer's demonstrated understanding of AF mission requirements, the potential contributions of the proposed research to the mission of the Air Force, and the likelihood of the proposed effort to develop new research capabilities and broaden the research base in support of national defense.

2. Other evaluation criteria used in the technical reviews, which are of lesser importance than the primary criterion and of equal importance to each other, are:

a. The proposed interface between the winning team and the Air Force for the purpose of transitioning the generated information.

b. The principal investigator's team leader's, or key personnel's qualifications, capabilities, related experience, facilities, or techniques or a combination of these factors integral to achieving Air Force objectives, and the proposer's and associated personnel's record of past performance.

c. The realism and reasonableness of proposed costs and availability of funds.

d. Restrictions on the intellectual property, technical data, hardware and software developed under this grant (see Section VII.E)

No further evaluation criteria will be used in source selection. The technical and cost information will be analyzed simultaneously during the evaluation process. The US Government does not guarantee any awards will be made. Further, be advised that as funds are limited, otherwise meritorious proposals may not be funded. Therefore, it is important that proposals show strength in as many of the evaluation areas as practicable for maximum competitiveness.

VI. Award Administration Information

Award Notices – Successful proposers will receive a separate notice (acceptance letter or e-mail as indicated in V.3) stating that an application has been selected (before the award is in place). The notification letter or e-mail should not be regarded as an authorization to commit or expend funds (except at the recipient's own risk, to the extent that the recipient elects to charge up to 90 days of pre-award costs, as permitted under paragraph 32.25(d)(2)(i) of 32 CFR part

32). The Government is not obligated to provide any funding under an award in response to this BAA until a Government Grants Officer signs the grant document.

VII. Other Information

A. The cost of proposal preparation in response to this Announcement is not considered an allowable direct charge to any resulting award. Such cost is, however, an allowable expense to the normal bid and proposal indirect cost specified in FAR 31.205-18, or OMB Circular A-21, Cost Principles for Educational Institutions or OMB Circular A-122, Cost Principles for Nonprofit Organizations.

B. Every effort will be made to protect the confidentiality of the proposal and any evaluations. The proposer must mark the proposal with a protective legend in accordance with FAR part 15.6, Use and Disclosure of Data, if protection is desired for proprietary or confidential information.

C. Proposals should briefly address whether the intended research will result in environmental impacts outside the laboratory, and how the proposer will ensure compliance with environmental statutes and regulations.

D. Only contracting or grants officers are legally authorized to bind the government.

E. Intellectual Property

1. Proposers shall identify all aspects of the intellectual property, technical data, hardware, and software that they plan to develop under this award for which the Government will acquire less than unlimited rights and to list specifically what the restrictions are. In the event that proposers do not submit such a list, the Government will assume that it automatically has unlimited rights to all intellectual property, technical data, hardware, and software developed under this award. Furthermore, the Government will assume that it has unlimited rights to all intellectual property, technical data, hardware, and software developed under this award that is not listed.

2. Proposers are advised that proposals containing restrictions on intellectual property are by nature less favorable and valuable to the government. Restrictions will be considered in the evaluation process. If no restrictions are intended, then the proposer should state this fact.

F. Unnecessarily elaborate brochures or presentations beyond those sufficient to present a complete and effective proposal are not desired.

G. AFOSR documents are available on the AFOSR website at http://www.afosr.af.mil

H. Responses should reference Broad Agency Announcement AFOSR BAA 2006-05.